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FINAL REPORT FOR ONR GRANT N000140610607:
ADAPTIVE AND ROBUST RESOURCE ALLOCATION AND SCHEDULING

This grant has explored the design and implementation of adaptive and robust resource allocation and scheduling. It was motivated by the widespread dissemination of telecommunication technologies which enables entreprises and organizations to track their operations in real-time using technologies such as GPS, RFIDs, sensors, and high-performance networks. The ubiquity of telecommunication technologies led to a paradigm shift in business processes producing integrated supply-chains, sense-and-reponse logistics, and lean manufacturing to name a few. It is also producing a fundamental transformation in optimization and decision-support systems. Indeed, organizations can now exploit a wealth of historial and real-time data available, moving their traditional focus from a priori planning to real-time decision-making under uncertainty.

This grant has studied how to realize this paradigm shift. It has studied a wide variety of algorithms for decision making under uncertainty, large-scale optimization, and finding high-quality solutions to complex problems quickly. The main contributions have been

- The framework of online stochastic combinatorial optimization algorithms, i.e., the idea of making decisions during operations, sampling the distributions of the uncertainty, optimizing the obtained scenarios, and aggregating their optimal solutions into a robust solutions across all scenarios.
- The design and analysis of one-step anticipatory algorithms and their applications to a variety of routing, scheduling, and resource allocation problems.
- The design and analysis of multi-step anticipatory algorithms and their applications to resource allocation problems.
- The implementation of decomposition techniques for large-scale logistics applications and, in particular, the use of these techniques to find high-quality solutions quickly.

Publications

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[2] P. Van Hentenryck and R. Bent. *Online Stochastic Combinatorial Optimization.* Prentice Hall/India, 2007. (Reprint of [5])

[3] P. Van Hentenryck and R. Bent. *Online Stochastic Combinatorial Optimization.* The MIT Press, Cambridge, MA, 2006.

[4] L. Michel, E. Sonderegger, P. Van Hentenryck and A. Shvarstman Optimal Deployment of Eventually-Serializable Data Services. *Annals of Operations Research,* (to appear).

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Patents

1. Brown ID No.: BU2008-15.
PCT Application No.: PCT/US2009/001450 filed March 5, 2009.
Priority claimed from: U.S. provisional application no. 61/068,282 filed March 5, 2008.
Title: Gap reductions techniques for stochastic algorithms
Formerly known as: Improving scheduling and reservation systems one-step anticipatory algorithms

2. Brown ID No.: BU2008-16.
PCT Application No.: PCT/US2009/001449 filed March 5, 2009.
Priority claimed from: U.S. provisional application no. 61/068,327 filed March 5, 2008.
Title: Improved techniques for stochastic combinatorial optimization.
Formerly known as: AMSAA: A multistep anticipatory algorithm
for online stochastic combinatorial optimization.